

Challenges of changing a PBL-related curriculum for 1st year students

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Abstract

This paper discusses a transition related to a reformed study plan in the specific case of the Aalborg University education of Medialogy; a Bachelor and Master program with an average of 80 students starting 1st semester. Among other things, the change meant a new structure for preparation, teaching and evaluation for the course: *Cooperation, Learning and Project Management (CLP)*. This paper will discuss the implications, based on the students' understanding of the subject matter, the degree of practical use of the course curriculum in their project work, and compare it to the former study plan. The method used is based on an analysis of the students' Process Analyses, a learning portfolio, where a project group of up to 7 students analyse and reflect on the CLP-related process of realizing their semester project. The theoretical background of the comparative analysis is based on the coherence on cooperative learning, reflection and action science, which leads to a suggestive understanding of the overall impact of the study plan reform. The conclusions show that the reform suggests several improvements, but also that these take time to fully practically implement. The introduction of clear learning goals has shown to be constructive, especially if included more clearly as an explicit part of the lectures than it has been the case. It suggests to use them as a pedagogical method, leading to both subject matter overview and guidance towards the expected level of understanding. It is also clear that it is crucial to provide students concrete and practical experiences with fundamental PBL concepts, before they are capable of grasping and absorbing its more abstract depth. The teacher should therefore keep a content-related foresight and teaching approach, that contains both very concrete information, but without losing the deeper, abstract perspectives that comes from semi-structured dialogue.

1. Introduction

In recent years, many new engineering educations have been established at Aalborg University (AAU). Until summer 2010, all educational programs at the Faculty of Engineering and Science had very similar 1st year curricula, despite having different Bachelor and Master programs [1]. This was due to the original Aalborg University structure, and for 2010 it was decided to change this approach by reform, so the curricula could fit the individual programs. In the end, the only part remaining of the previous cross-program shared curriculum was a course addressing the University's use of the problem based- and project organized learning model (PBL). The challenge for the reform design was to define essential aspects in a uniform material package shared by all programs, while keeping program-specific diversity. The result was a 5 ECTS course coined *Problem-based Learning in Science, Technology and Society (PS)*, divided into two course partitions *Science, Technology and Society (STS)* and *Cooperation, Learning and Project Management (CLP)*. In addition, PS was now evaluated, based on various formulated learning goals, encompassed in three main evaluation parameters: Knowledge, Skills and Competences. The exam was a 7-hour written individual exam, based on a fictive but program-relevant case study, encompassing areas of both CLP and STS [2].

This paper focuses on the CLP partition only. It poses the question of how the reform changed the CLP course and whether the students' outcome was improved. Upon describing structural and practical changes following the reform, the method will be to compare the competence level of the students studying under the two curricula and reflect on both the experiences brought by

the reform and the impact of the changes for the future. The method used is collected data from the study regulations, course material, students' Process Analyses, and exams results.

Due to their close relationship, the following section will give a brief description of the background of PBL, its connection to CLP and thereby introduce the concept of the Process Analysis evaluation method.

2. PBL, CLP and Process Analyses

PBL and its close relation to project work provide students with practical and theoretical skills in project-oriented problem solving. The skills are not necessarily program specific and can be transferred to a range of contexts. Amongst other things, it has shown to be highly beneficial in relation to making the transition from education institution to employment in industry [3][4]. Meanwhile, acquiring a complex skill but also being able to verbally describe its delicate functionality is not a given. Often students are acquiring their PBL-related skills on a tacit level [5].

This question has been a focus at the research group *Engineering Education and Organizational Learning* at Aalborg University for many years, and has led to the development of the CLP course and curriculum [6]. Besides teaching students tools and techniques to strengthen their project planning and management, CLP focus on the cooperation within the project group by working with communication aspects and learning approaches. The purpose is to improve the creative- and decision-making processes, both in the project group as a whole and between group members. Last but not least, CLP has the students practise a reflective approach to their own roles as individuals, the roles of their individual group members and the project group as a whole.

While the lectures of CLP encourage dialogue, the students (i.e. the project groups) are forced to break the tacit boundary by writing a *Process Analysis* (P.A.). Historically, the P.A. was introduced in 1982 at Aalborg University as part of an *instruction* procedure to the PBL model. It was but a few written pages and meant to strengthen the learning outcome of the course material. During the 1990s, the P.A. developed into a longer written documentation, to be handed in shortly after the semester project. In this period, CLP began an era focusing more on *reflection and theory*. The lectures became more theoretical and the P.A. followed this trend, being given its new role as a written reflection on the students' own process-related experiences with their project [6].

Since 1999 (and currently), the P.A. has matured into what is often referred to, as the students' *learning portfolio*. It remains a written assignment and is both process documentation and reflection. In both cases, all is related to tools or considerations of the CLP curriculum [6]. Meanwhile, different from the previous P.A. era, the students now need to illustrate their planning and progression through the project. This includes showing how and why e.g. certain planning procedures were implemented, but as important – if/how they changed. Therefore, the students need to collect any appropriate documentation while still working on the project. Concrete examples are time schedules and methods of progress monitoring. Changes in these areas serves as the initial indication that decisions had to be made, which means that planning and reality didn't match at one point. Either the reason or the consequences are sometimes worth reflective attention in the P.A. Considerations like *group contracts* are also described and relate to both planning and communication issues – which often lead to conflicts. These are often discussed subjects; with either deep or wide spectra for reflection. The ability to put perspective on the project process through reflections is typically what allows a P.A. to reach a high level of accomplishment. Qualified and well-argued discussions often lead to reflections that, in turn, combine into conclusions that touch upon several areas within the project in relation to CLP. The P.A. is made 3 times during the 1st year (2 semesters). One smaller P.A. is made in the beginning of the first semester (couple of pages). Two larger P.A.s (10+ pages) are made at the end of the first two semesters. The reason for the emphasis on the Process

Analysis is, that it is the only way to compare the learning outcome before and after the reform, as the written exam was not part of the previous study plan [2].

3. Old vs. New – the changing CLP curriculum/study plan

Following the old study plan, CLP content was spread out on two semesters. Five headlines outlined the content: Purpose, Reasoning, Goals, Content and Organization of Teaching. Looking at *Goals* and *Content* there are respectively 4 formulated Goals and 7 near-single word bullets for Content. The *Goals* headline deals with (shortened in this translation from Danish) 1) analysis of the project groups' cooperation and organization, 2) reflection concerning reasons and solutions to conflicts, 3) evaluation of own effort and learning method and identifying related weaknesses for future program success and 4) arguing for techniques concerning planning and managing project work. The *Content* headline dictates the following short bullets: cooperation, conflict management, learning, problem-orientation, project planning/managing, structuring of knowledge, written and verbal scientific communication of project results. *Organization of teaching* explains how the course is split into several lectures where theoretical lectures are paired with practical exercises, role-play, group exercises, case studies, etc. In few words, it concludes with mentioning the gathering of material for the Process Analysis as the evaluation method [1].

The reform took the same objective as the previous study plan, but expanded with perhaps four main areas: 1) It had the curriculum content re-structured, 2) it had the content elaborated and directed, 3) teaching methods was made completely open and 4) the course now had individual written examination. In terms of *re-structuring*, any course in the reformed framework should have qualifications listed for a passing student, framed by 3 overall segmentations: Knowledge, Skills and Competences. These have previously been referred to as *learning goals* in this paper and for CLP there are 12. The following is an example of a learning goal for the *skills* segmentation: (the passing student) "*Must be able to analyze and evaluate own contribution to study and learning, especially regarding identification of strong and weak factors and, based on this, consider continuous course of events and their contributions to the learning processes, learning styles and the study*" [2]. The example resembles *goal 3* from the former curriculum, but the new formulation is 1) only one of a couple that addresses this issue and 2) much more specific, detailed and is thereby more *elaborate and precise*. This makes the reform curriculum appear more consciously directed towards an overall goal. In terms of *teaching method*, which caused large changes for other courses there was no change for CLP, given its former, rather open study plan teaching description. Last but not least, the 7 hour individual, written exam. Unquestionably the biggest change between the two study plans, this exam was also the target for all 3 learning goal segmentations. The method of the 7-hour exam was for the students work with a given case and related to the problem in the case to take the role of project managers, and use knowledge from CLP to argue for various managing choices given by the assignment. This made the exam form somewhat of an opposite to the former evaluation method of the group-based reflective evaluation process of the Process Analysis – which also related itself to the PBL project. The project groups still have to write a Process Analysis with the new study plan, but not formally linked to the CLP course. It is now formally and exclusively evaluated (by the CLP teacher, however) as part of the group-based PBL project [2].

4. Teaching the new study plan

Part of the specific requirements from the study board in relation to the new study plan, was for all courses to produce a table overview of the course content (lecture title, encompassed learning goals, topics and content cue-words, duration, etc.). For CLP, this showed a good opportunity to get overview and clarify which of the learning goals would be dominant as themes, which other learning goals would then fit under these themes and which lecture-chronology would be most beneficial. The CLP course was planned so that the 12 learning goals were all clearly included over the course of 7 lectures. Table 1 shows the content of the lectures.

Table 1: Content of the CLP lectures, following the new study plan [2]

Lecture #	Content
1	Introduction: the concept of CLP, PBL, project work, group work, cooperation vs. individualism, expectation, group contracts (encompassing 7 learning goals)
2	Communication: understanding through listening and listening methods, communication forms, learning and learning styles (encompassing 6 learning goals)
3	Conflict solving: importance of honesty in group work, group types, the project supervisor, structuring and conducting meetings, meeting discipline and procedures, worksheets (encompassing 7 learning goals)
4	Recap: on experiences of first mini-project, introduction 1 st Process Analysis (encompassing potentially all previously exposed learning goals)
5	Workshop: Creative problem solving (organized together with STS course) (encompassing 7 learning goals, shared with STS)
6	Academic writing: how to: project reports, report structures, phases of the project discussion on the concept of reflection (encompassing 5 learning goals)
7	Process Analysis elaborated: reflection re-visited (encompassing potentially all learning goals)

Partly inspired by this change (Table 1) and partly due to a new teacher, the actual teaching method/approach was also partly changed, e.g. illustrated by how the approach to the keynote slideshows was changed. Through Figure 1 and Figure 2, its illustrated how a new and different visual style was introduced, as well as a different approach to using the visuals consciously as a simple guide to make associations, communicate and even amplify e.g. the emotion of the course material.

Figure 1: An example of a 2009 PowerPoint slide-design for CLP. It introduces the concept of Conflict and its various faces. Lots of text makes it difficult to familiarize with the slide and listen to the teacher at the same time (slides were in Danish at the time) [8].

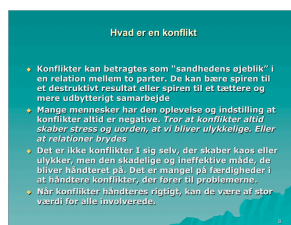
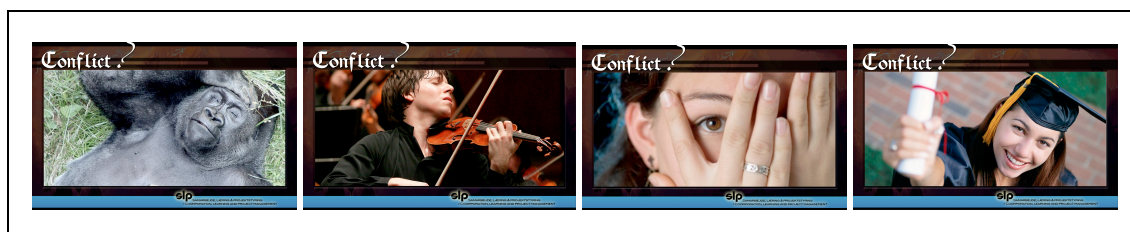


Figure 2: Example of four keynote slides from CLP 2010, lecture 3. They are part of the sequence that introduces the concept of Conflict and its various faces. No text allows the speech from the teacher to stand alone, while still providing associations to the spoken words. Often, such a sequence would end with a dialogue between students and teacher [9].



Looking at the images in Figure 1 from the left: (image: gorilla) we have conflict all around us – ergo we are accustomed to conflict, (image: violin-player) conflict can represent a struggle we have to face to do something constructive, (image: fear) conflict pushes some people and keep

them away (image: graduate) recognizing, approaching, dealing with and overcoming conflicts can be seen as a fundamental tool to move beyond any starting point.

The rationale was to try and catch the attention of the (in most cases) young students. According to the personal experience as a new CLP teacher, the biggest danger with the course was the luring tendency of the curriculum looking like plain, common knowledge. If the course would fail to catch the attention and provoke the new students to rethink concepts like “listening”, “communicating”, “conflicts” and “reflection”, and realize that no one were actually not very good at any of these, the purpose of the course would fail. The new teacher was given free hands to test his ideas, while being in close communication with the other, experienced teacher of the course. Whether this new approach to teaching CLP was optimal will be discussed a bit later in this paper.

Now that the background for the study plan reform has been disclosed, it is time to look at the impact of the new additions and approaches, on the learning outcome with the students.

5. Learning outcome - comparison

This section will look into whether or how the changes in the study plan actually made a noticeable impact. The method for doing so has to be split into segments, as there are inconsistencies between the two study plans that does not allow for a direct comparison. The only immediate evaluation method they share is the Process Analysis. That leaves the individual 7-hour written exam for the new study plan open, but not as anything else than a possible set of data to support possible trends. It might be useful to put a P.A. comparison into perspective.

5.1 Process Analysis comparison

Comparing Process Analyses is tricky unless there is a clarified framework for the comparison. The reason for this is, that the P.A.s have no formal structure or requirement that e.g. all groups must follow. Before writing their P.A the project groups are encouraged to take charge and make some personal choices for their P.A. They need to choose the topics and also how they are weighed. This should be done, according to what they want to base their main reflections upon. From a comparison perspective, this means that there is no way of actually mirroring two P.A.s next to each other. Neither a “chronological” comparison of the progression in the P.A.s, nor simply following the same topics is often possible.

So for this comparison, it was found that comparing the P.A.s, (both comparing within one study plan and comparing between study plans), would have to begin with comparing the overall level of the assignments in general (between study plans). Hereafter, a look at possible common traits in the overall use of CLP tools could be an option.

The normal procedure for evaluating P.A.s is by making an overall, wide assessment of the combined effort and quality. The evaluations are based on the study plan, with focus on the coherence between the chosen subjects, as previously described in section 2. As the students are advised to consider, addressing fewer areas, the focus on these should allow for deeper reflection. This way, some smaller considerations or experiences are left unmentioned, but that is often a worthy trade-off. P.A.s are given a suggestive grade between *high above average* and *much below average*, the former still being considered a passing grade. It is very seldom that P.A.s are failed, though it has been known to happen.

The project group receives the evaluation in an official document, where formulated feedback is provided, relating to their specific assignment. The feedback is typically quite thorough and bases itself around constructive criticism, as the P.A. is considered a learning process, more than a strict evaluation. It is these feedback documents that will be the source material for the comparison in this paper.

The comparison made in this specific case, is based concretely on 11 P.A.s from December 2009, made by project groups from 1st semester Medialogy and 11 P.A.s from December 2010, also made by project groups from 1st semester Medialogy. In Table 2, the distribution of grades is shown by the number of times the grades have been assigned.

Table 1: Comparison between 2009 and 2010 Process Analyses, from 1st semester Medialogy students [10] [11].

Grade / year	2009	2010
<i>High above average</i>	2	3
<i>Above average</i>	2	2
<i>Average</i>	3	1
<i>Below average</i>	3	4
<i>Much below average</i>	1	1

The results shows that while there are inconsistencies between 2009 and 2010, they are not very clearly pointing in a certain direction. That 5 groups managed to place them selves above the average threshold in 2010 *is* satisfying, but with noticeably fewer *Average* grades and more grades *Below Average*. It could indicate, however, that the level of the students has not necessarily dropped from 2009 and 2010. The quality of the P.A. assignments varies a lot and a general level is difficult to determine. It indicates a situation where trends or common/uncommon traits will be necessary to provide any indications of the transition between study plans. Looking at the feedback, it seems the trends of the two semesters are the same.

The P.A.s from both 2009 and 2010 reminds the reader who made them – new students, and individuals without any real experience in the situations and choices that they are encouraged to reflect upon. An example or areas that stand out is the lack sufficiently effective and updated *planning*. The project schedules included in the P.A.s illustrate that most of the 1st semester students have simply not been used to, perhaps even required to work on several things in parallel. The consequence is that the schedules have not received the attention necessary to render them useful, which in turn means that they have been abandoned. The same is the case with other methods of agreement across project group members. Numerous examples are found in both 2009 and 2010 in relation to group contracts, where the rules of the project participation is never upheld, creating insecurity and sometimes, even chaos. Project leaders and other roles, who would place initiative in the project are explicitly stated to have been missing in the groups during the project. Often, the argument for why it had not been implemented was, that it was not considered necessary when the group was still in the early periods of the projects. The conclusion in all P.A.s has to sum up what the students need to improve and what they want to improve in their next semester. In general students are forced to reflect based on their described and analysed experience and their strategies for their next semester are quite impressive.

The above are examples of the same thing: elements of the CLP curriculum that has not been missing emphasis during lectures – even during project supervision, which is in theory external from CLP lectures. There seems to be no noticeable difference between 2009 and 2010 in these areas, which point towards two things. One is that the semester introducing the new study plan reform did not suffer noticeably from the transition, but that it has not shown any significant improvement in the learning of the students. The second, and perhaps the biggest point is the challenge of how to bring the 1st semester students into a mind-set that places weight on these fundamental CLP considerations and concepts earlier than after having completed a whole semester.

6. Discussion

There are several ways of approaching the questions above. There seems to be initiatives made after the introduction of the new study plan that have potential, but have not yet reached it fully. The visuals and style of keynotes seem to have the ability to catch the attention of the students, and several students have expressed their positive thoughts in that relation. It seems it makes them pay attention, that the slides are light on text, that they create visual associations and that there is a large diversity to indicate the progression through the course material. On the other hand, the clarity of the topic that the lecture is addressing at any one point might not be as clear from looking at a single slide out of context of the teacher and the verbal communication. This is especially the case when the student wants to revisit the slideshow at a later point in time.

This point is also brought forth by the obvious lack sufficient use of CLP terms (on a broad scale – some students are quite capable, of course) in both the P.A. and actually in the 7-hour individual exam in 2010. In section 3 and 4, the learning goals following the reform was received as a nice specification of the requirements of the course. While the information is available to all students through the study plan, these goals would benefit the lectures by being much more explicitly pointed out as core considerations and anchor points to remember for the students. This point is important, for as it was mentioned towards the end of the previous section, the 1st semester students are not able to listen, remember and segment the information the same way as students who have been more accustomed to life as a student. It is necessary in the future to be very aware of what information the students are being exposed to and when. The formulated learning goals of the study plan could be implemented as exactly as the recognizable anchor points and thereby serve as part of a more pedagogical method of gradually breaking in an overview of the course material. This places emphasis on CLP terms and could make it easier for the teacher to branch out and introduce additional terms, by building on the basis of the learning goal and anchor points.

Meanwhile, dialogue with the students, while it hasn't been given much space in this paper, was stellar in many ways during the lectures. As such, we could regard some lecture parts, semi-structured conversations between teacher and students. This seems to break down some of the "plainness" distance to the CLP concepts for the students and in turn create an interest in their complexity. This was done much through personal anecdotes from practical examples; by the teachers' own experiences from PBL project work.

One way these anchor points could be given the appropriate attention is through practical exercises made during the lecture. Learning styles [7] was by far the most prominent/consistently mentioned topics in the P.A.s, which was one of the few practical exercises that was made during the lecture. The constructive perspective to that procedure was that they worked on the course material and realized something, but that it was repeated and discussed immediately after they had worked on it. Almost all other exercises were given the students to make after the lecture, and from the look of the P.A.s, these topics were not nearly as prominent or well described. Given the circumstances of the course context (the "plain, common sense" syndrome), this might be the method of exercises in the future might be integrated in the lecture time.

Another point that has not been given a lot of space until now, but deserves the attention is the fact that the introduction of the reform also meant the introduction of a completely new exam procedure. While the design of a case study (which was the chosen exam form) is not the biggest problem in the world, the real problem was that the decision to make it a case study was not made until late into the semester, because the actual study plan was still maturing in certain areas, even beyond semester-start. From a course planning perspective and in relation to the just mentioned anchor points, it was not a recommendable situation. To be teaching a topic without being sure how to formulate its relation and relevance for the final evaluation creates confusion, both for students and teacher. Of course, during the lectures, topics from the curriculum could be placed in the context of several anecdotes in relation to project work and

CLP in general. But as previously mentioned, very few 1st semester students (at best) are actually able to relate to those concepts (e.g. project work and group collaboration). This renders any reflection level of CLP unobtainable, and that is why, in context of the lack of experience, it might be suggested that the words “you need to know this at the exam” ironically works better than “this will really mean a lot for your group dynamics”. For “group dynamics” to get its deserved weight with the students, they need practical PBL experience. And so, while the anchor points of the learning goals seem to be a good step on the way of creating CLP term-related awareness at an early stage, it might need the already “known” consequence-relation of an awaiting exam to facilitate the necessary awareness.

Which brings in the level of reflection displayed in the exam assignments. Again, some P.A.s were very good and some individual 7-hour written exams in 2010 also contained fair levels of reflection, but it seemed that the deeper level of reflection are very hard to have the students realize on the 1st semester. Referring to the just written argumentation, this makes sense, but that does not mean that it's not possible to improve upon. This again, seems to relate back to a lack of knowledge / memory of terms and concepts from the course. Taken into account how many students participated in the conversations during the lectures, this also refers back to the points made earlier in this discussion. There needs to be a better balance between dialogue, anchor points, foresight in terms of reminding the students what they need to remember for the exams to do well and more practical exercises during class.

All in all, with all the transitions made at once; new teacher, new study plan, new material, new exam form and re-planning of the lectures, it could have gone a lot worse. And the fact that a lot of experiences are made on that basis seems to be able to pay off in the coming years.

7. Conclusion

The conclusion is that the transition suggests several improvements.

The learning goals proved very useful in terms of course/lecture planning and checking that the content was there and directed appropriately.

For CLP, it is extremely important to be very aware, that the students really need concrete and practical experience with the PBL concepts, before they are able to absorb the terms, grasp their importance or understand their more abstract concepts. Seeing as this cannot be forced upon them as such, the introduction of clear learning goals, taken from the study plan itself, seems to show surprising potentials compared to its previous use. The learning goals can be used in the lectures as a pedagogical method, working as anchor- or reference-points from where other CLP terms might more easily branch out and facilitate a better use of the CLP terms. Bringing the learning goals into the lectures early could also provide a sense of purpose, until the students realize the usefulness of the knowledge in the projects. The teacher should keep a content-related foresight and a teaching approach that contains concrete information. Meanwhile, the lectures should not lose the dialogue-based and more abstract perspectives, as they are often what places the concrete information in context of the real world and removes it from being “plain, common knowledge”. In the end, the changes of the CLP curriculum have shown to have a large impact on the course, both due to the sheer novelty of planning an entire course from scratch, but also the interesting rationalizations made after was completed.

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